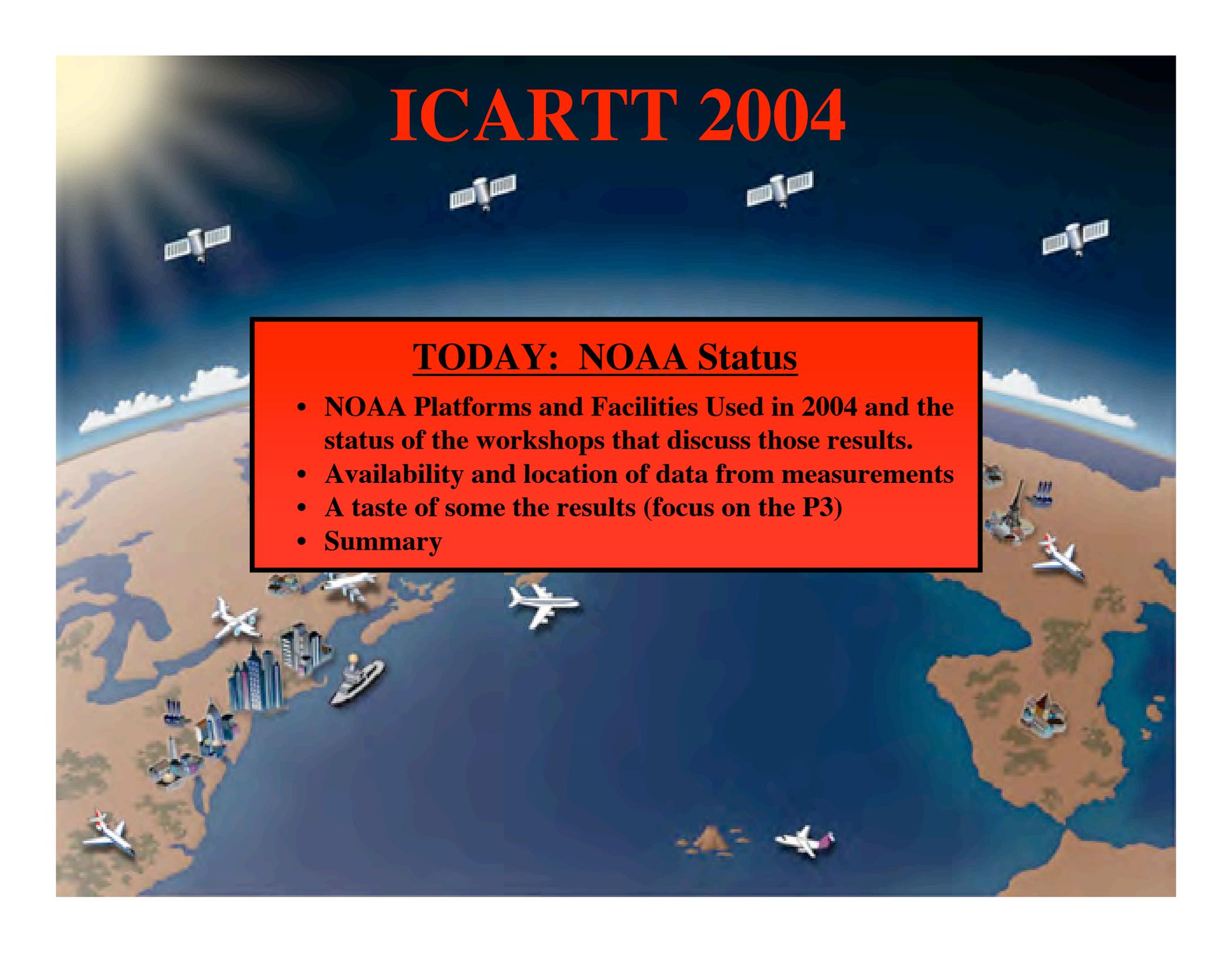


# ICARTT 2004

The background of the slide is a stylized illustration of Earth from space. The top half shows a dark blue sky with a bright sun in the upper left corner, casting rays. Four white satellite-like objects with solar panels are positioned in the sky. The bottom half shows a brownish-tan landmass with various icons representing different types of assets: several white commercial airplanes in flight, a large blue and white cruise ship, a smaller blue and white cargo ship, and a small white boat. The overall theme is global data collection and transportation.

## TODAY: NOAA Status

- **NOAA Platforms and Facilities Used in 2004 and the status of the workshops that discuss those results.**
- **Availability and location of data from measurements**
- **A taste of some the results (focus on the P3)**
- **Summary**

# NOAA Platforms and Facilities Available in ICARTT 2004

## NOAA WP-3D Lockheed Orion



### WP-3D/DC3 Workshop

(Boulder, CO; April 11 - 13)

Data available on AL/ICARTT website.

Requires ICARTT username and password.



### Ronald H. Brown Workshop

(Boulder, CO; March 15 -16)

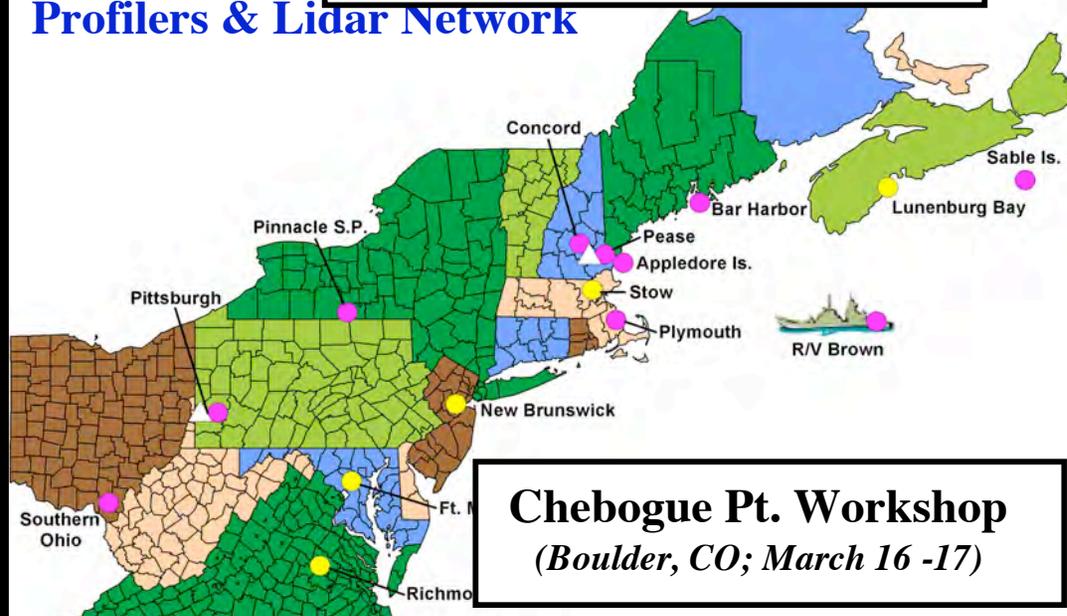
Presentations and data available on the PMEL & AL/ICARTT websites.



## Aircraft



## Profilers & Lidar Network



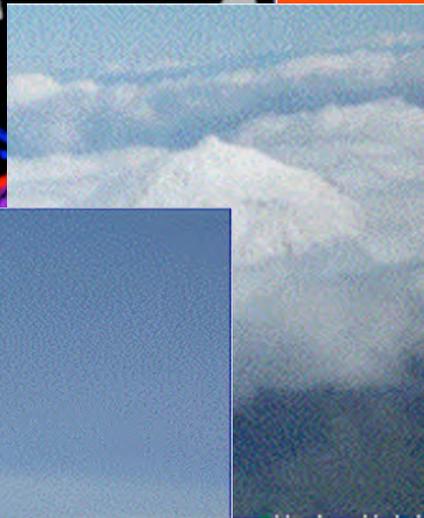
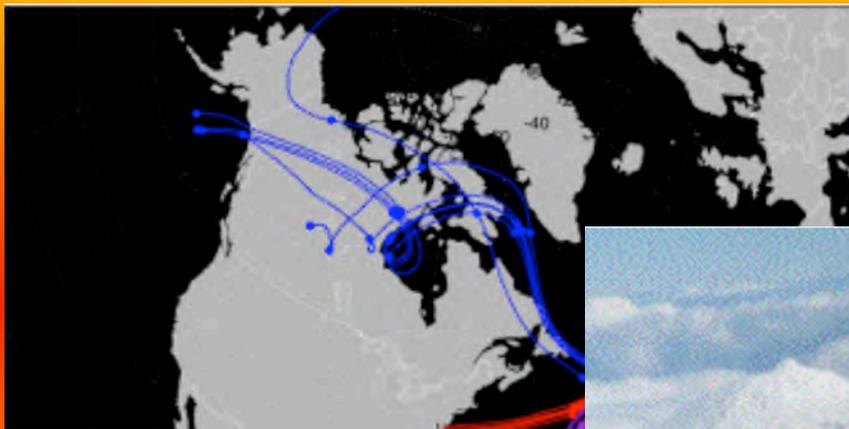
### Chebogue Pt. Workshop

(Boulder, CO; March 16 -17)

# NOAA and NSF

Chebogue Point: Location and site 

Pico: Location and site 



## Chebogue Pt. Workshop

*(March 10 and 11)*

*The Chebogue Point presentations (in pdf format) and data are available at Chebogue Pt. ftp site:*

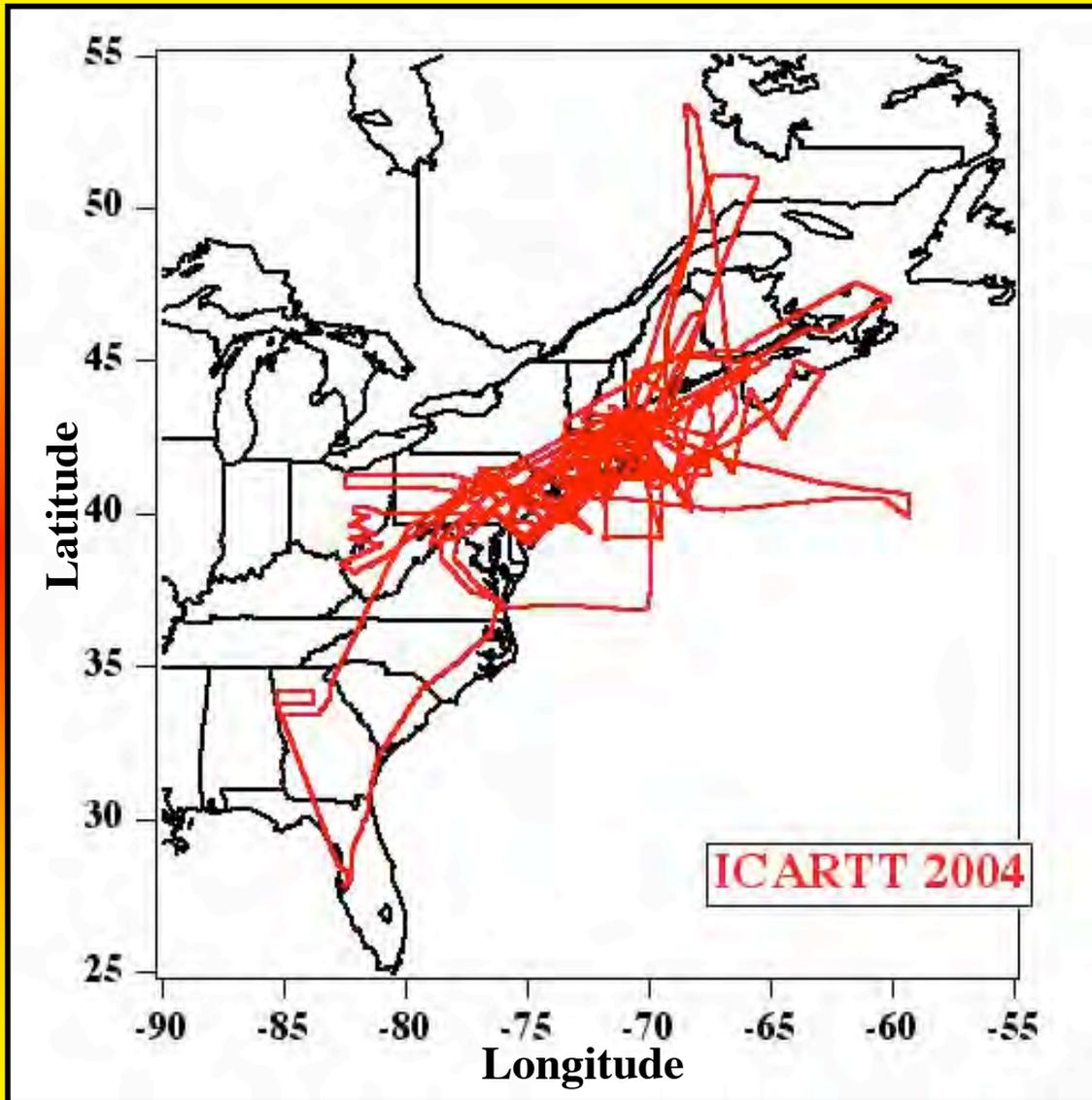
- *Host: [ftp.al.noaa.gov](ftp://ftp.al.noaa.gov)*
- *User ID: chebpt*

# NOAA WP-3D Research Aircraft

*A Taste of Some the Results from 2004*



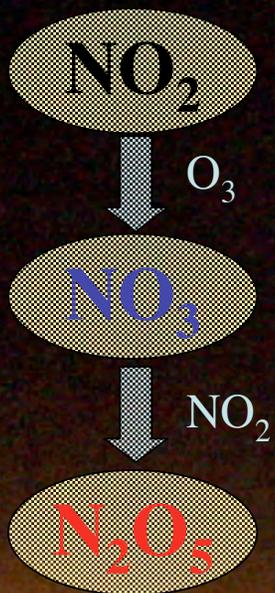
# A Taste of Some the Results from 2004



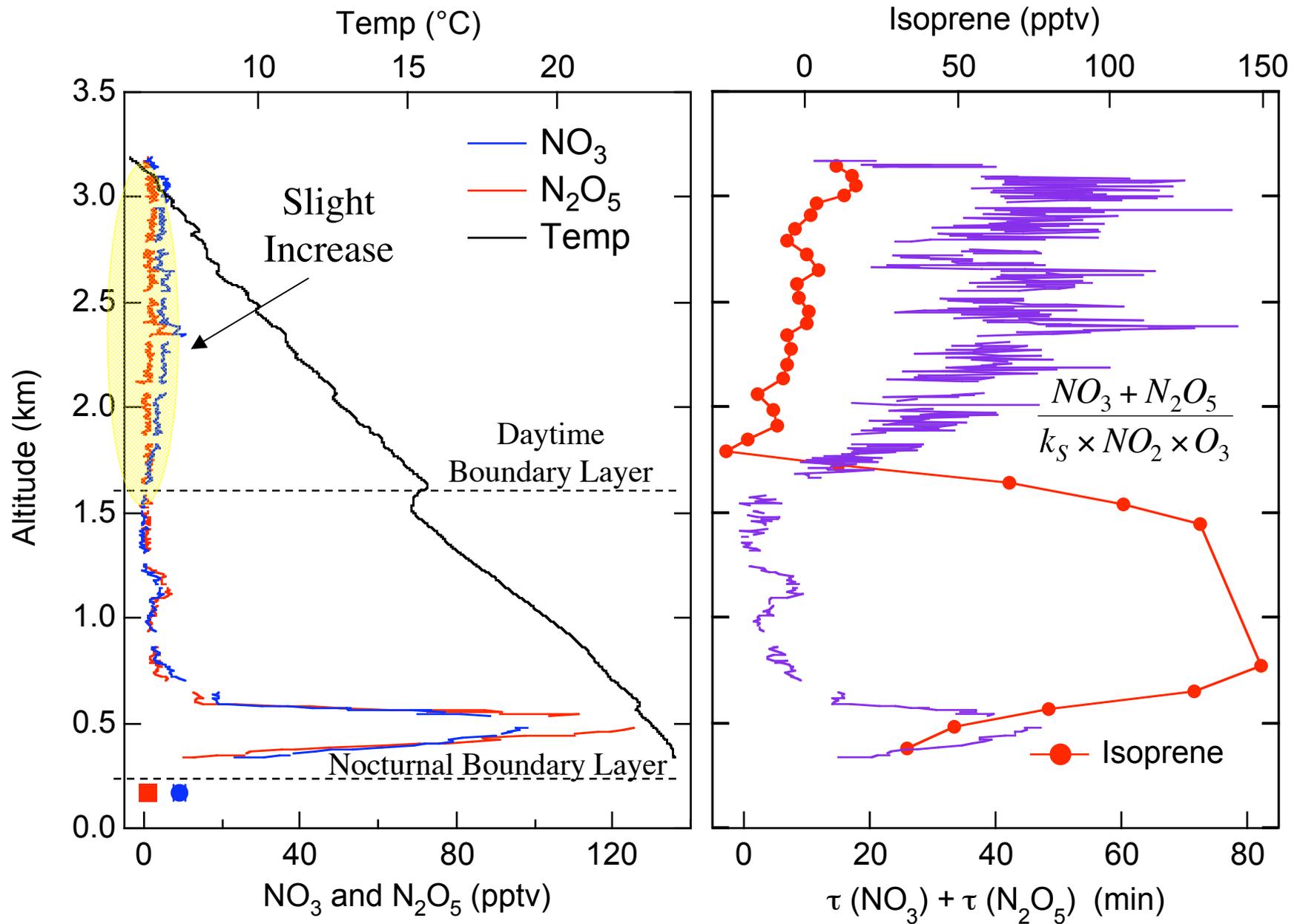
**During ICARRT Eighteen Flights (~ 130 hrs.) Studying:**

- *Urban plumes (day and night)*
- *Power plant plumes*
- *Forest fire plumes*
- *Regional composition and chemistry*
- *Forecast model evaluation*
- *Long-range transport*
- *Intercomparison activities*

# Atmospheric Chemistry after Dark



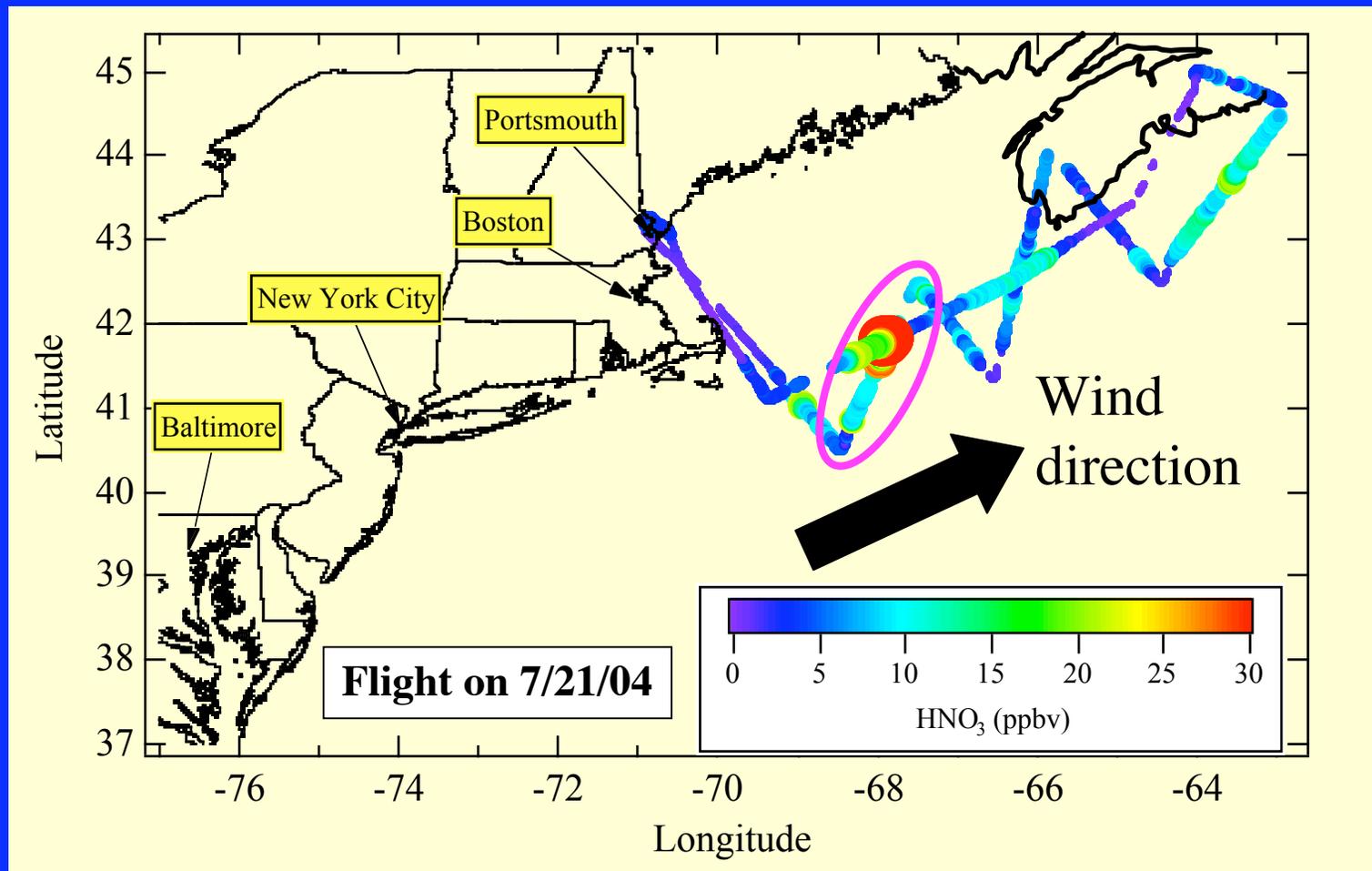
# Vertical Profile Over Appledore Island - Aug 3, 2004



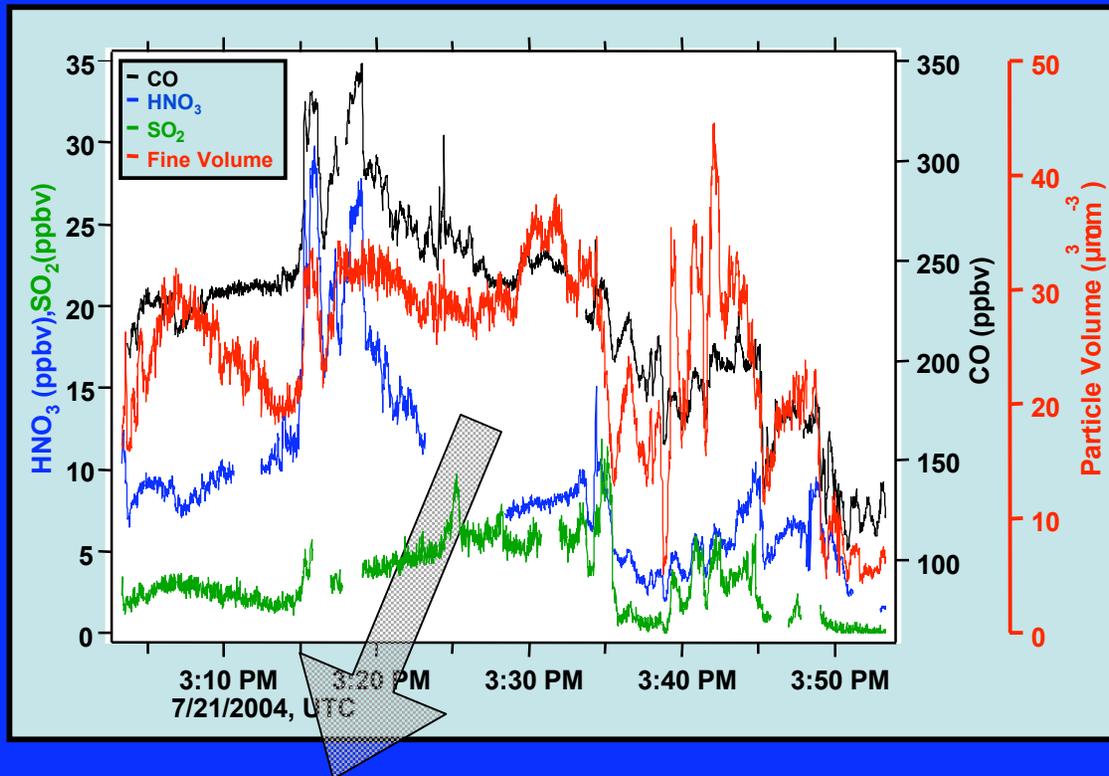
# Tracking East Coast Oxidation Products over the Atlantic

*Data from flights on July 20, 21, 22.*

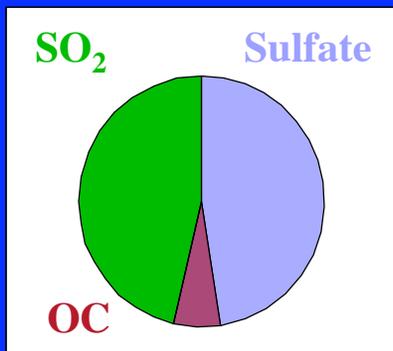
*CO, HNO<sub>3</sub>, SO<sub>2</sub>, aerosol measurements from NOAA WP-3D.*



# Pollution plumes over the Atlantic



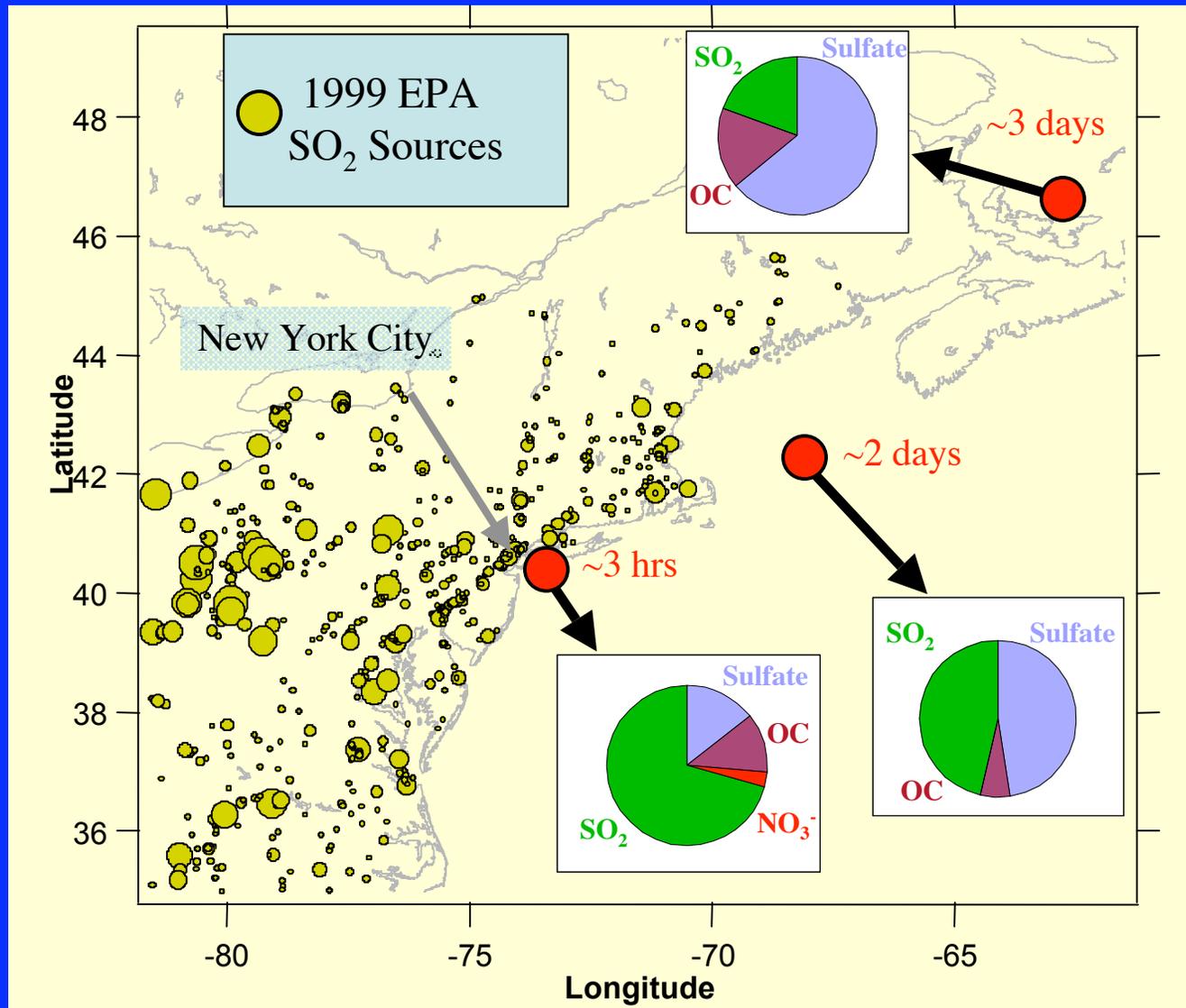
- The CO reflects crossing a mixture of East Coast sources.
- HNO<sub>3</sub> was the most abundant reactive nitrogen species and correlated with CO. (*flexpart retro-plume analysis indicates ~ 2 day transport time*).
- SO<sub>2</sub> not highly correlated with CO.
- SO<sub>2</sub> and fine particle volume are well correlated and greatly enhanced in plume.



- Most of the fine particle mass is sulfate (PILS, R. Weber, GIT).
- Water-soluble organic carbon (PILS, R. Weber, GIT) is generally < 15% of the fine mass; suggests < 30% total organic contribution. (OC estimated from WSOC\*2.25.)

**Particulate sulfate and potential particulate sulfate (from SO<sub>2</sub>) dominate aerosol mass.**

# How does aerosol composition change with aging plume?

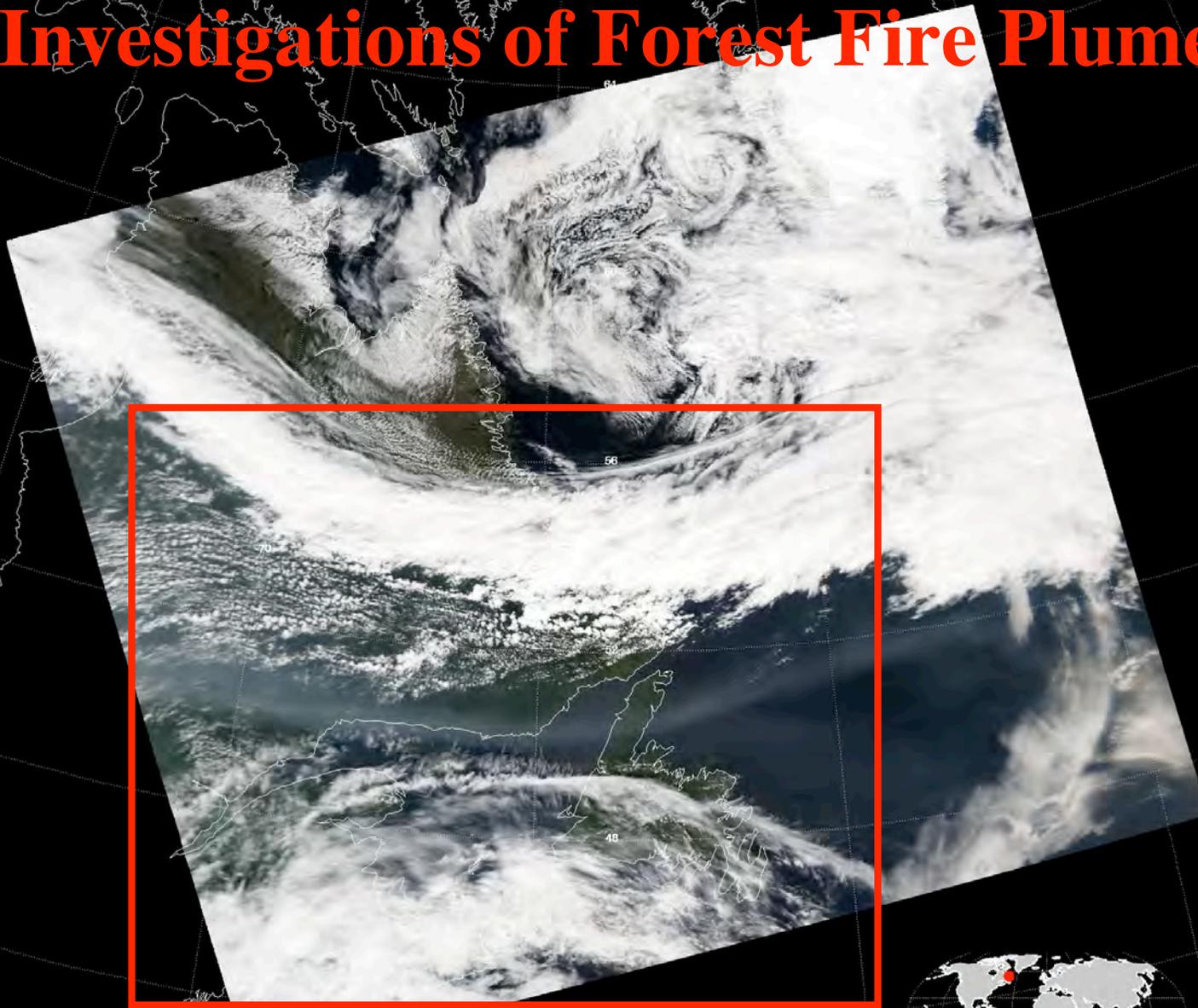


- Many SO<sub>2</sub> sources embedded along urban corridor.
- Plumes crossed on 7/20-21-22.
- Flexpart retro-plume analysis indicates E. Coast sources
- Total OC fraction < 30% fine particle mass (OC fraction estimated from WSOC).

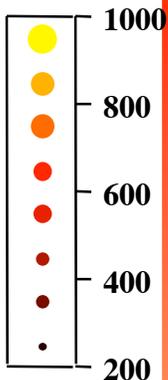
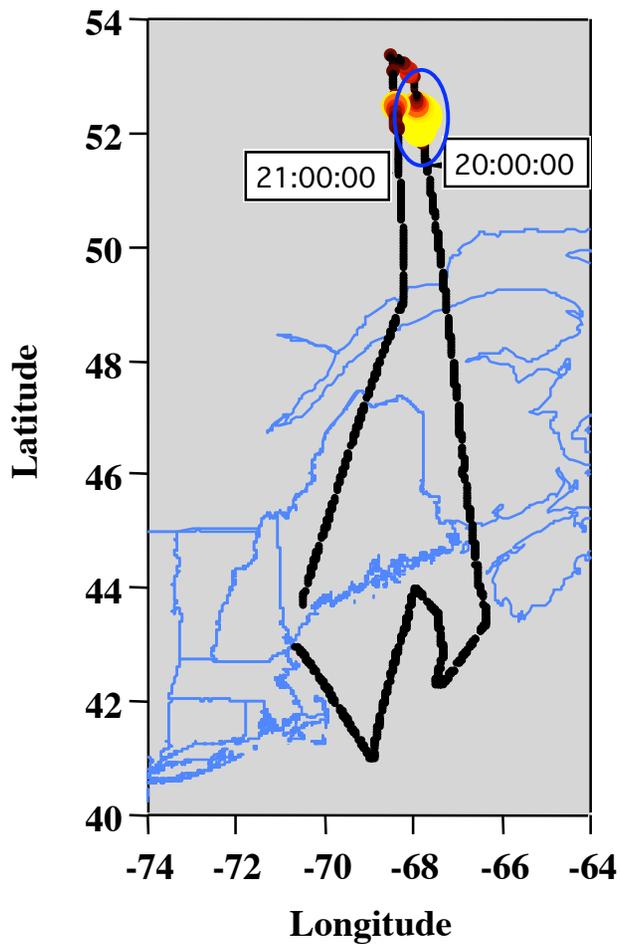
**Sulfate and Potential Sulfate (SO<sub>2</sub>) Dominate Exported Fine Particle Mass**

MYD021KM.A2004210.1635.004.2004211165449.hdf  
Aqua MODIS Truecolor Scene

# Investigations of Forest Fire Plumes



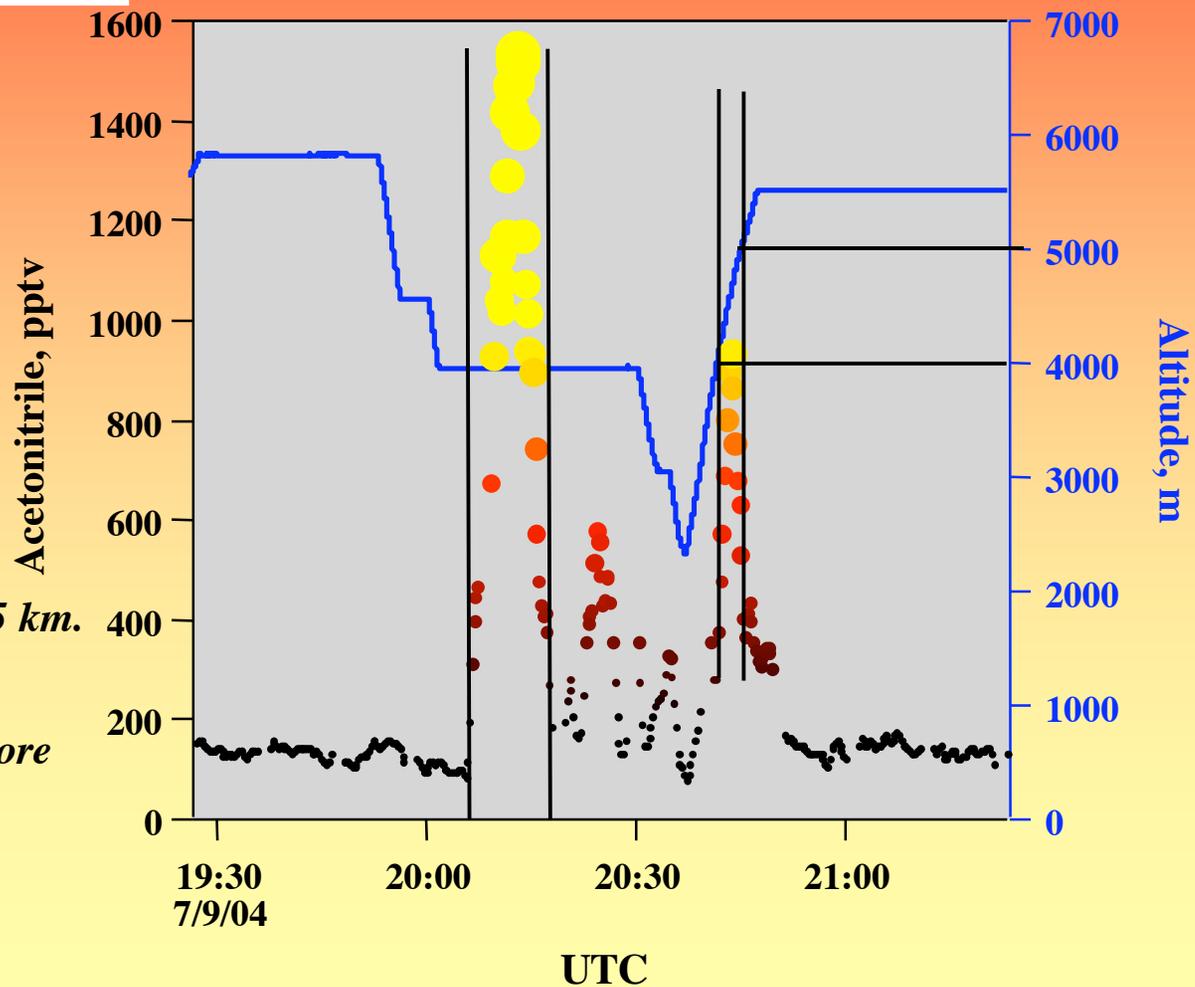
**Very Interesting but many questions.**



## NOAA WP-3D Measurements

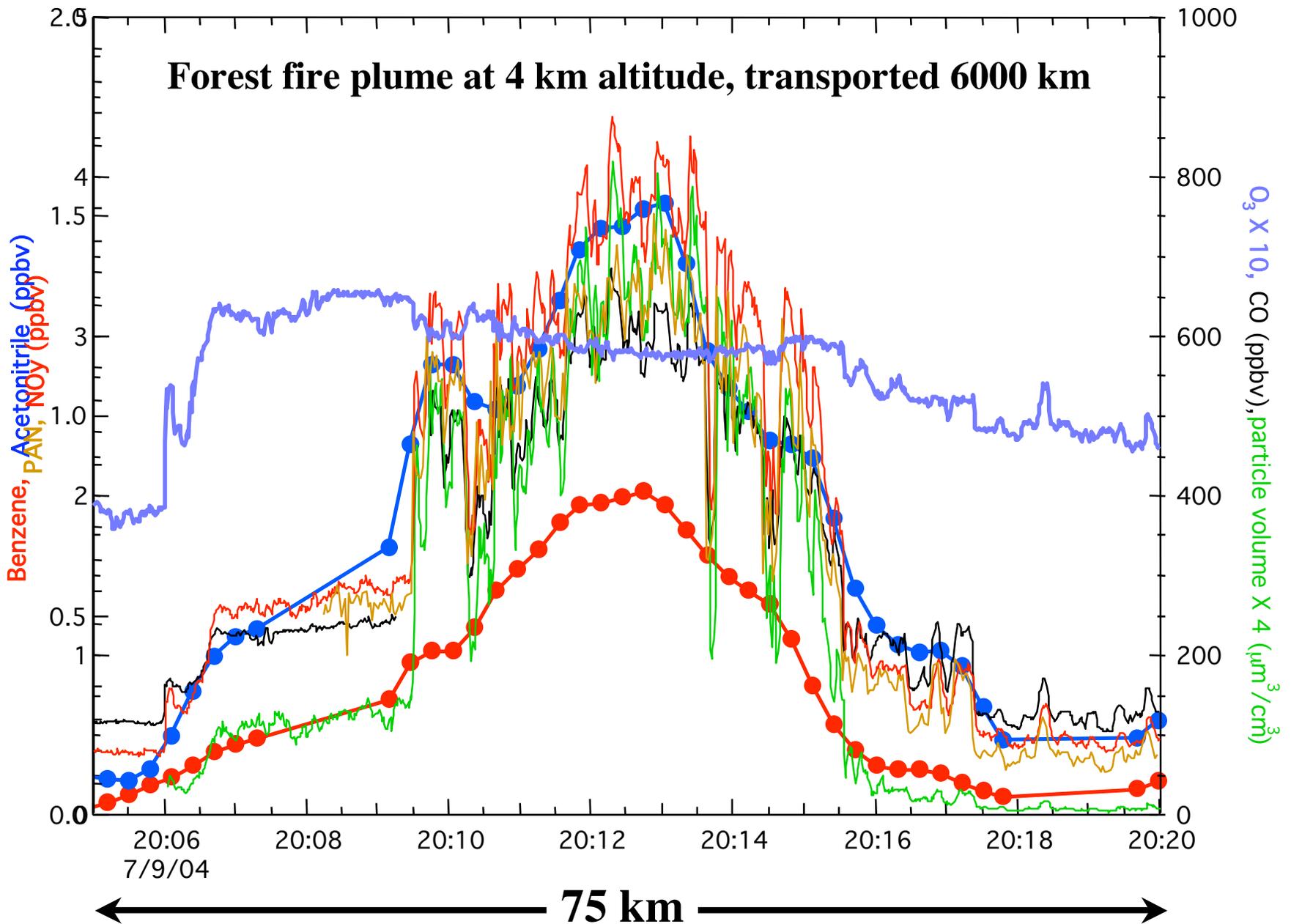
### Forest Fire Plume 7/9/04

- *The NOAA P3 crossed the plume between 20:06 and 20:20 UTC.*
- *The P3 then doubled back and did a profile through the plume.*

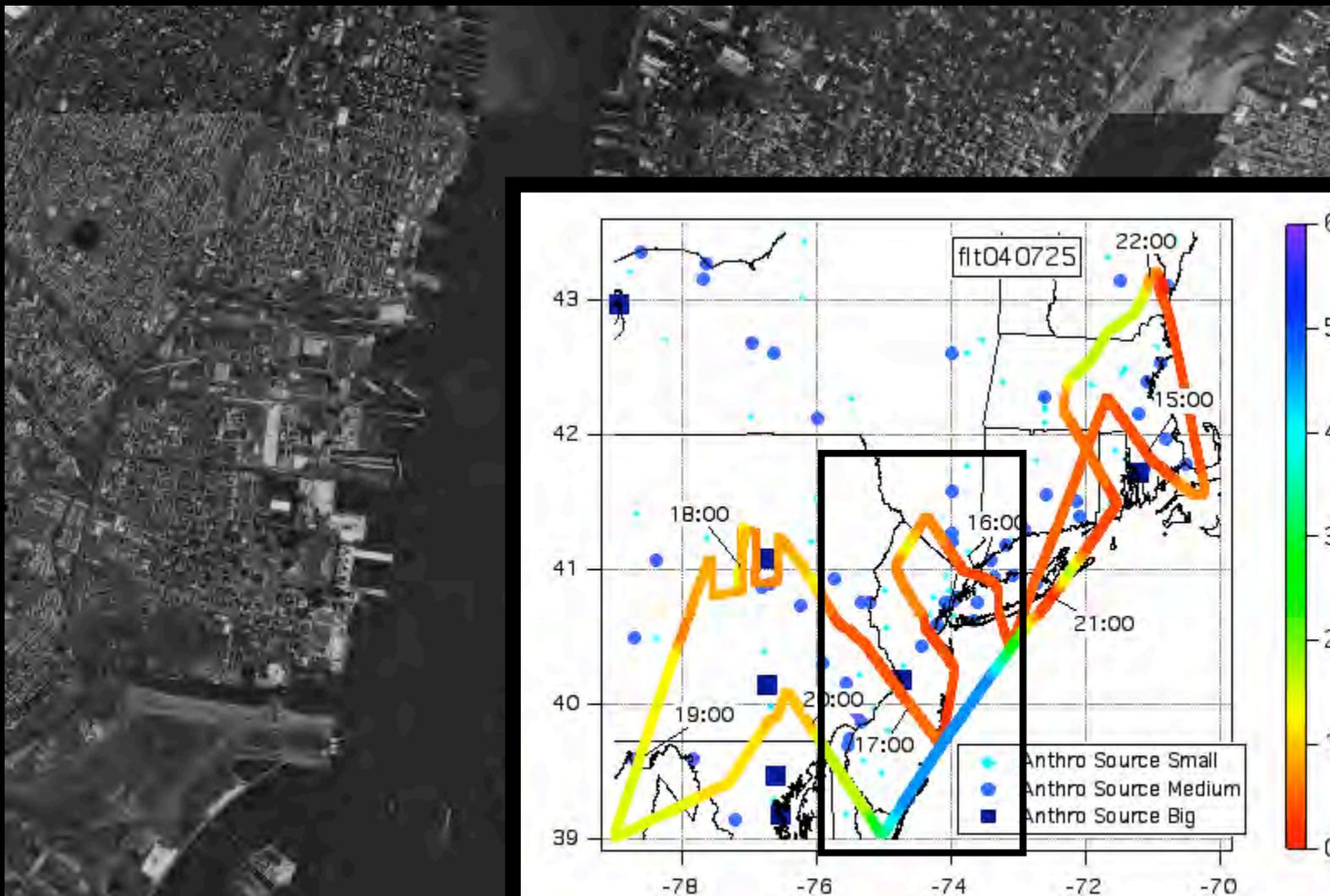


- *The plume was approximately 75 km. wide and one km. thick.*
- *We will look at the crossing in more detail*

# NOAA WP-3D Measurements

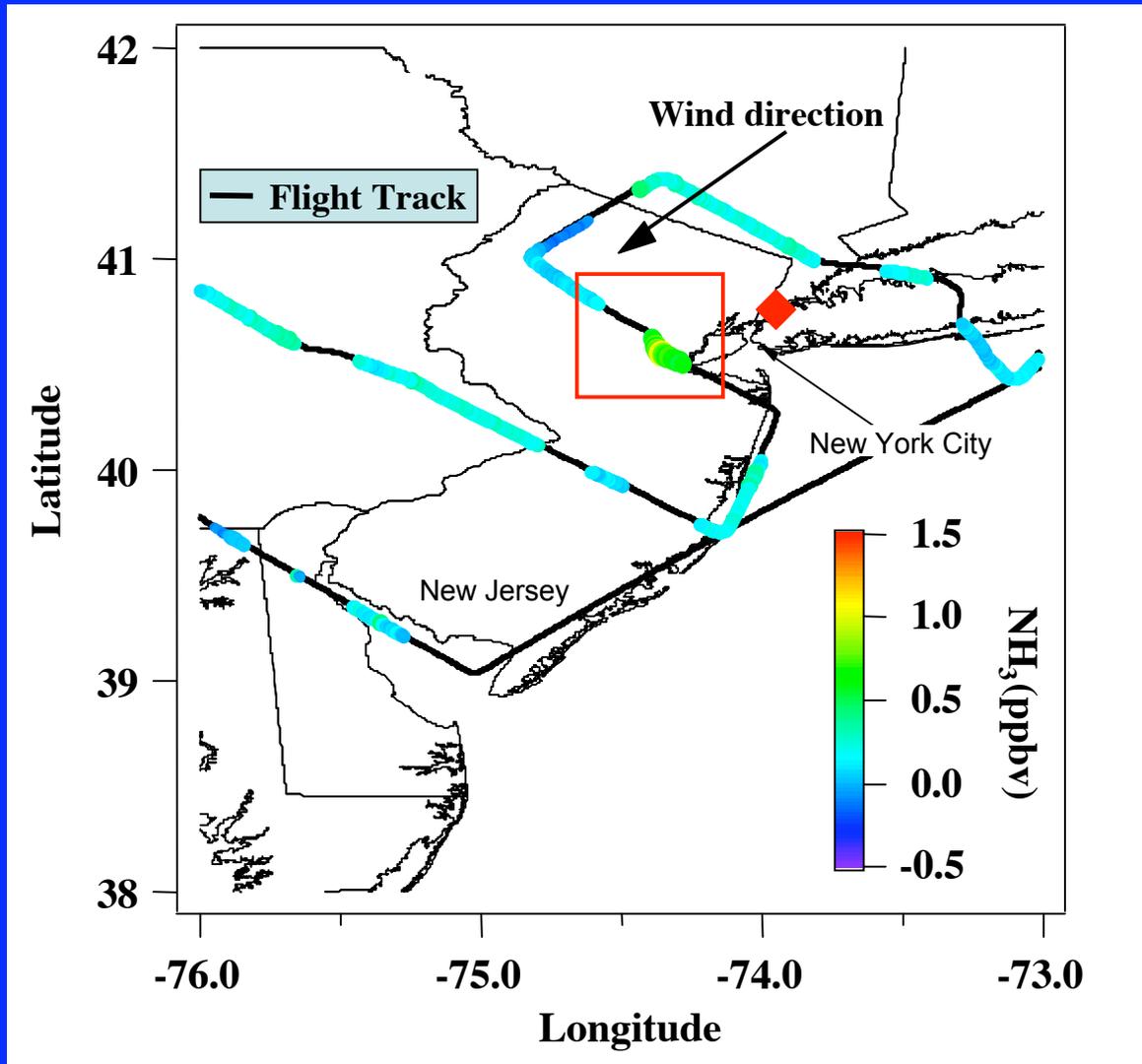


# NH<sub>3</sub> in the New York City Plume



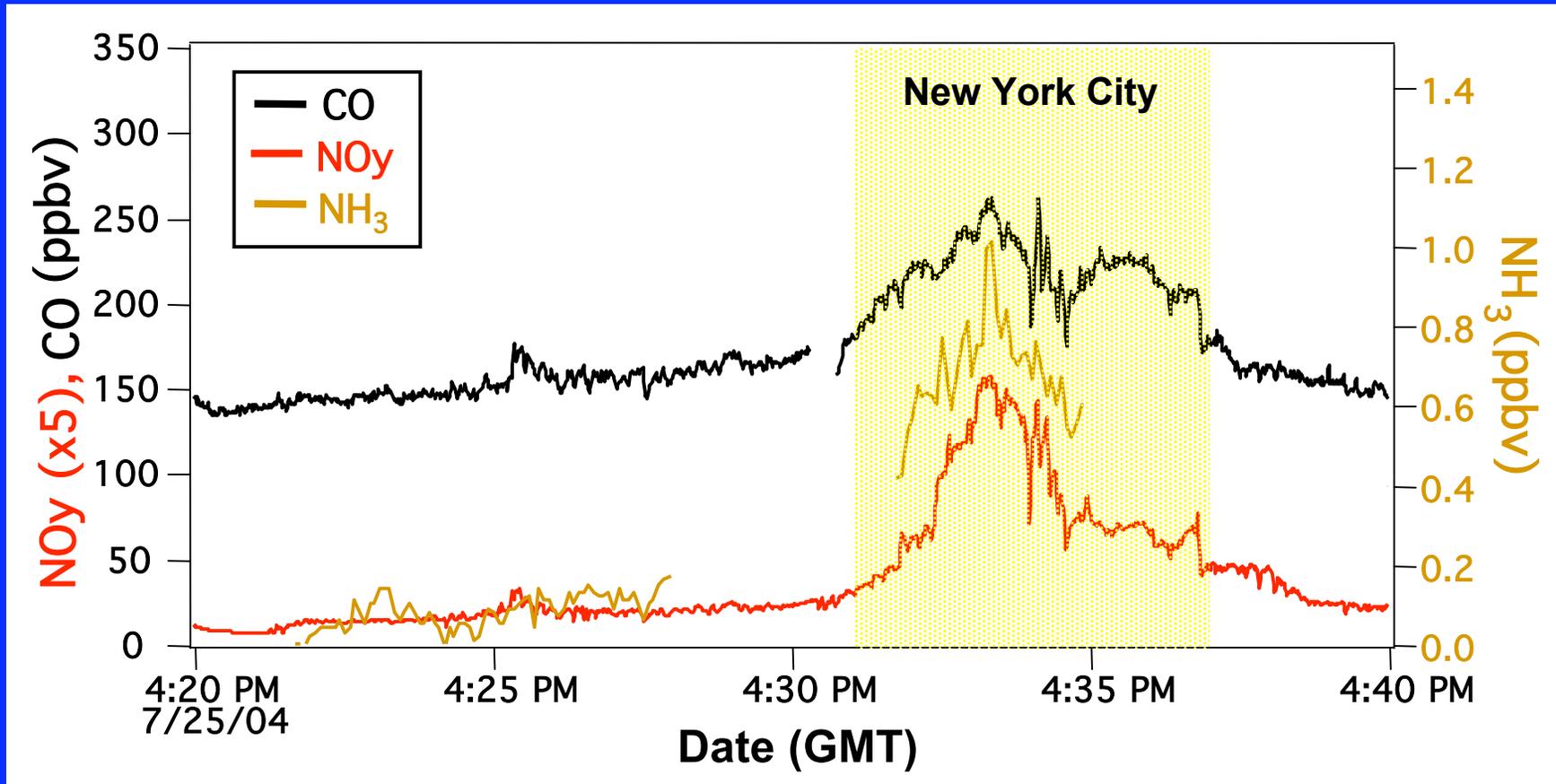
Out first results on the P3 using a recently developed CIMS chemistry

# New York NH<sub>3</sub>



- July 25th flight downwind of New York City
- Flight track colored and sized by NH<sub>3</sub> mixing ratios.

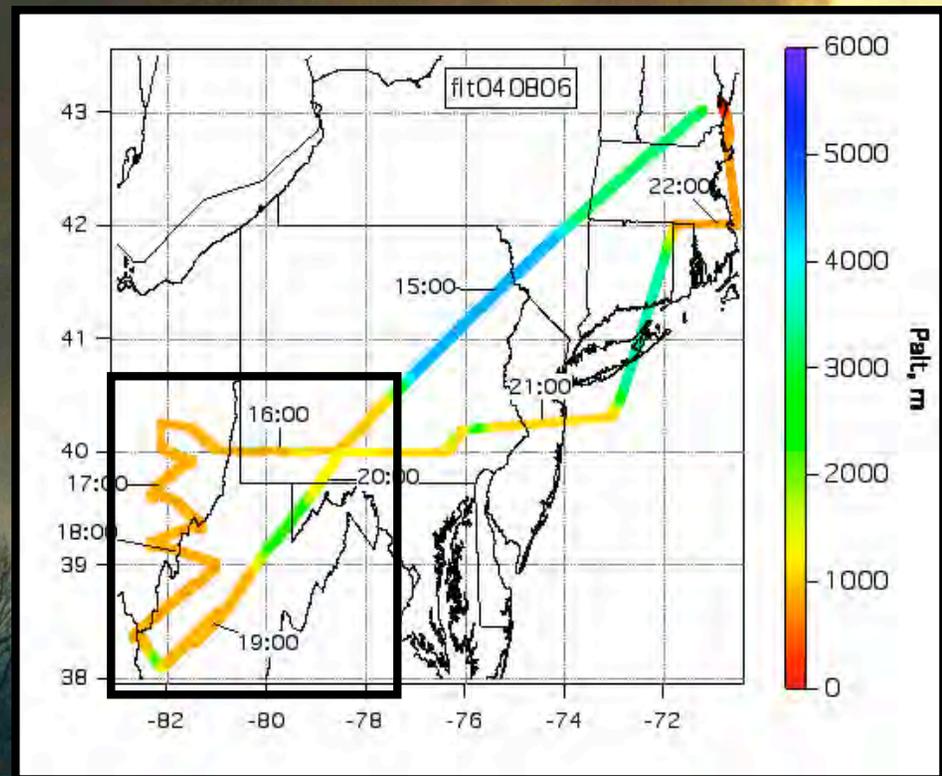
# New York NH<sub>3</sub>



- Time series shows NH<sub>3</sub> correlated with CO and NOy in New York city outflow.
- NH<sub>3</sub> observed in forest fire, urban, and some power plant plumes.

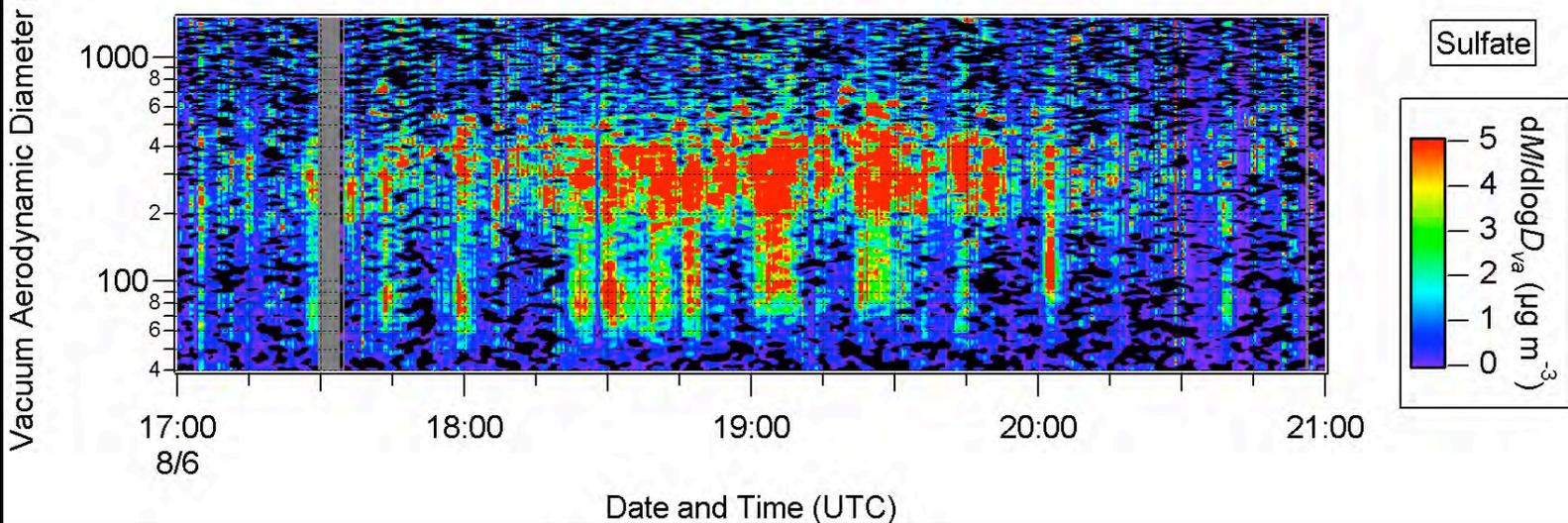
# Investigating Power Plant Emissions

*The emission from seventeen different power plants were studied.*



# Power Plants Study: Flight on 8/6/04

- Daytime flight
- Wind from the north-north-west
- Power plants and flight tracks are colored by SO<sub>2</sub> emissions.



# Conclusions from Power Plant Studies

**During ICARTT, we obtained the plumes from several power plant on different days plumes at different stages of chemical evolution. Near the plant:**

- **High levels of aerosol sulfate were measured (often more than 15  $\mu\text{g}/\text{m}^3$ ).**
- **Most (>90%) of the total sulfur was still in  $\text{SO}_2$ .**
- **Very little ammonium -> acidic particles**
- **Very little organic mass -> probably not enough precursor.**

**As the plumes aged:**

- **Particle sizes increase, due initially to sulfate increases.**
- **Further downwind, aerosol ammonium and organic mass increases.**
- **When clouds were present, cloud processing rapidly converted  $\text{SO}_2$  into aerosol sulfate.**

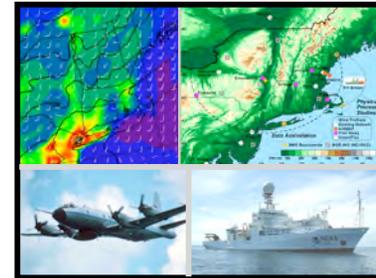
**Findings: We made measurement in plumes downwind of several power plants that had revised their emission inventories (EI) since 1999. The result:**

- **2003  $\text{E}(\text{NO}_x) \sim 50\%$  1999  $\text{E}(\text{NO}_x)$**
- **2003  $\text{E}(\text{SO}_2) \sim 85\%$  1999  $\text{E}(\text{SO}_2)$**
- **Updated EI agrees with observations**

# SUMMARY

NOAA:ICARTT-2004)

We established broad goals for the study that we were able to accomplish. Some important findings are:



- *It's a whole new day for the night!*
- *Sulfate dominated the exported fine particle mass.*
- *The aerosols measured after long-range transport were largely neutralized.*
- *We have obtained a wealth of new information about the transport and chemical transformation processes that are occurring in forest fire emissions.*
- *Nitric acid and aerosols can be efficiently scavenged by clouds.*
- *NH<sub>3</sub> was measured (a first for the P3) in urban, forest fire and some power plant plumes.*
- *Air quality has significantly reduced the emission of NO<sub>x</sub> and SO<sub>2</sub> from power plants in the Northeast.*



*We stand ready to share our results with our study partners.*